Spring 2015

# The Restoration Process: Lessons from a Community-Based Conservation Initiative in Tunkhel, Mongolia

John Wendt
*SIT Study Abroad*

# The Restoration Process:

## Lessons from a Community-Based Conservation Initiative in Tunkhel, Mongolia

Wendt, John
Academic Director: Sanjaasuren, Ulziijargal
Advisor: Batkhishig, Baival
Colorado State University
Rangeland Ecology
Tunkhel *Tosgon*, Mandal *Sum*, Selenge *Aimag*

Mongolia: Geopolitics and the Environment, SIT Study Abroad, Spring 2015

## Abstract

As policy makers transition away from central planning, Mongolia's natural resource professionals are challenged with cultivating community support for stewardship in a time of escalating ecological disturbance. Nutag Action Research Partners has partnered with community members and government officials in Tunkhel, a small village in north-central Mongolia, to develop local resource management capacity and jointly draft a Conservation Plan for a commonly grazed riparian pasture. This study is a preliminary assessment of the ecological and social factors influencing project implementation. Information was collected using a variety of qualitative methods including meeting observation, surveys, interviews, photographs, and a review of previous studies. Findings indicate that project success is at risk of being hampered by a host of factors including low participation rates, conflicting goals, time constraints, perceptions of resource devaluation, inaccurate ecosystem characterization, and failure of cross-scale collaboration. The case study offers actionable suggestions to mitigate threats to project success.

Keywords: **Natural Resources and Conservation**, **Natural Resources Management Policy**, **Ecology**, **Environmental Studies**, **Environmental Sciences**

# Table of Contents

## Acknowledgements

This project would not have been possible without the gracious support I received along the way.

My thanks goes to my Academic Director, *Ulzii Bagsch*, for her direction and support throughout my time in Mongolia.

I would like to thank my advisor, *B. Batkhishig.*, for her invaluable wisdom, guidance, and feedback.

My thanks to the SIT Mongolia staff for expert support and teaching throughout the semester.

I would like to thank the entire *Nutag Partners team* for welcoming me into their office, allowing me to work alongside them, and inviting me to join some unforgettable nights of table tennis and other shenanigans.

I am especially grateful for the assistance that I received from the Nutag Partners project team: *L. Tamiraa*, *Ts. Zulaa*, and *D. Wilson.*

Thank you, *J. Azjargal* and *Zaya,* for translating during my trips to Tunkhel.

And my thanks goes to my peers, friends, roommates, travel partners, and fellow explorers: *Adrian, Andie, Dave, Denise, Hannah, Jolina, Lucy, Mabel, Margaret, Rebecca, and Winston.*

# List of Figures, Tables, and Abbreviations

# Introduction

Community members and government officials in Tunkhel, a small, agricultural village in north-central Mongolia previously expressed interest in protecting and improving the conditions of a local riverside pasture. In November 2014, Nutag Action Research Partners (Nutag Partners), a Mongolian NGO based out of Ulaanbaatar, was commissioned to manage the implementation of the project funded by the Global Environment Facility Small Grants Program (GEF SGP). The project is officially titled the Community-Based Riparian Meadow Protection Initiative (CBRMPI) and is classified as a biodiversity protection and capacity development project. Over the course of the twelve month project, Nutag Partners is seeking to engage local community members, government officials, and other stakeholders in the natural resource management and planning process.

For a month and a half, I was embedded within Nutag Partners as both an observer of and participant in the implementation of the CBRMPI. I took an action research approach to studying the project implementation process – that is, I conducted research aimed at improving community knowledge and practices in the process of a change situation.

In this paper, I assess the current status of the CBRMPI and make recommendations for future implementation based on my understanding of the project site's ecological and social status.

## Statement of Problem

Mongolia is experiencing a period of rapid ecological change. Rising temperatures (Angerer, Han, Fujisaki, & Havstad, 2008; Dagvadorj, Natsadorj, Dorjpurev, & Namkhainyam, 2009; Nandintsetseg & Shinoda, 2013), altered precipitation patterns (Nandintsetseg & Shinoda, 2013; Dagvadorj, Natsadorj, Dorjpurev, & Namkhainyam, 2009), pasture degradation (Khishigbayar, et al., 2015; Hilker, Natsadorj, Waring, Lyapustin, & Wang, 2014), landscape fragmentation

(Galvin, 2009; Takehiko, et al., 2013), deforestation (Tsogtbaatar, 2004; Eckert, Hüsler, Liniger, & Hodel, 2015), increasing livestock densities (Khishigbayar, et al., 2015; Shabb, Chitnis, Baljinnyam, Saagii, & Zinsstag, 2013), and mining development (Janzen, Priester, Chinbat, & Battsengel, 2007; Warner, Wester, & Bolding, 2008) are contributing to accelerated ecological degradation throughout the post-socialist nation. Policy-makers at all administrative levels recognize the need for innovative solutions that protect natural resources while supporting the livelihoods of local resource users.

Community-based natural resource management and ecological restoration are two approaches that can help support the sustainable management of natural resources in Mongolia: the former as a social-political framework and the latter as a technical undertaking involving ecosystem manipulation. Principles of both of these disciplines are relevant to the CBRMPI. In this paper, I seek to characterize the ecological and social context of the CBRMPI, identify potential risks and barriers to project success, and propose actionable solutions to mitigate developing challenges.

## Justification of Study

As an action research organization, Nutag Partners strive to acquire and share knowledge as they implement projects, thereby bridging the gap between policy and knowledge. They are interested in generating scientific information that is credible (scientifically accurate and technically believable), salient (relevant to decision makers' needs), and legitimate (procedurally unbiased and fair) (Cash, 2003) through participatory research. Participatory research considers community members, policy makers, and natural resources as subjects of the research study as well as parts of the research process (Batkhishig & Reid, 2009) thereby "deepening our understanding of the human dimensions of natural resource management" (Arnold & Fernandez-Gimenez, 2008).

This assessment of the ecological and social conditions influencing the success of Tunkhel's CBRMPI will have several practical uses. This study has been conducted in an effort to lay the groundwork for future inquiry that satisfies the criteria of action research, that is, research that produces information relevant to decision-makers in a developing situation. The primary purpose of this document is to serve as a summary of current knowledge regarding social and ecological factors that influence the CBRMPI implementation and success. Nutag Partners will utilize this document when drafting a final Conservation Plan for the CBRMPI. Furthermore, it can serve as a briefing document to familiarize stakeholders with the current status of the CBRMPI.

## Literature Review

According to Fernandez-Gimenez et al., "CBNRM and its cousins, co-management, collaborative resource management, and community-based conservation, have been adopted as the dominant paradigms for rural development and conservation" (2015). Community-based approaches are promoted as a means to enhance social accountability and legitimacy of decisions, build trust and strengthen social networks, and promote creative decisions representative of stakeholders and their interests (Rudeen, Fernandez-Gimenez, Jessica, & Meiman, 2012). Under this paradigm, it is held that conservation success requires that local communities receive sufficient benefits and participate in management (Gibson & Marks, 1995).

Since Mongolia's transition to democracy and a free-market economy, CBNRM principles have been formally applied in herder communities. Previous research has indicated that community-based approaches in Mongolia have resulted in social and ecological benefits including increased adaptive capacity of communities to successfully respond to winter disasters (*dzud*) (Fernandez-Gimenez M. E., Batkhishig, Batbuyan, & Ulambayar, 2015) and increased forage availability on community-managed pastures (Leisher, Hess, Boucher, van Beukering, & Sanjayan, 2012). Others have advanced that the benefits

of community control are often overstated and/or unsubstantiated (Addison, Davies, Friedel, & Brown, 2013). Nevertheless, community-based approaches can be a compelling alternative to other management regimes such as land privatization and central control.

A second recent shift in natural resource management theory and practice has been the transition from passive conservation (Mehta & Kellert, 1998; Reading, Johnstad, Batjargal, Amgalanbaatar, & Mix, 1999) to active ecological restoration (Hobbs & Harris, 2001). Ecological restoration is promoted as a tool for mitigating global environmental change in an era of increased degradation when simply conserving resources may not be enough to mitigate global human impact (Hobbs & Harris, 2001; Sundig, 2011; Wilson, 1992). Ecological restoration has been commonly considered as a solely technical matter; but authors have advocated an expanded view of the discipline that includes historical, social, cultural, political, aesthetic, and moral aspects (Higgs, 1997; Baker & Eckerberg, 2013). This study will explore technical ecological considerations for the CBRMPI while also embracing a more comprehensive view of the restoration process in recognition that other contextual factors can affect success.

Despite widespread disturbance from a variety of sources, the explicit application of ecological restoration in Mongolia has been almost completely limited to mine reclamation projects conducted by large foreign national companies (The Asia Foundation, 2009). The discipline of restoration ecology and the practice of ecological restoration are not well established in Mongolia as evidenced by the lack of pertinent literature.

Although not officially a restoration project in name, the intent of the CBRMPI is not to simply conserve but to actively facilitate the *recovery* of a degraded ecosystem. Restoration ecology and CBNRM approaches can be applied to the CBRMPI given the project's dual goals of improving community livelihoods and repairing environmental conditions.

## Definition of Key Terms

**Participatory Action Research:** A participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory worldview… [and bringing] together action and reflection, theory and practice, in participation with others in the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and communities (Reason & Bradbury, 2001)

**Adaptive Capacity:** A system's ability to adjust its behavior and characteristics to enhance its ability to cope with external stress (Brooks, 2003)

**Community-based collaborative natural resource management**: a group of diverse stakeholders who convene voluntarily to work on natural resource policy, planning, or management issues specific to a particular location (Wagner and Fernandez-Gimenez 2008)

**Ecological Restoration:** The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (Society for Ecological Restoration, 2004)

**Ecosystem Services:** the aspects of ecosystems utilized (actively or passively) to produce human well-being (Fisher, Turner, & Morling, 2009)

**Restoration Ecology:** The scientific discipline supporting the practice of ecological restoration

## Methods

The collaboration of the Tunkhel community, local government, and Nutag Partners provided a unique opportunity to study the implementation of a community-based conservation project In Mongolia. My research drew upon a variety of knowledge sources and data types in order to develop an accurate characterization of the site-specific social and ecological factors influencing project implementation and success.

I spent the duration of the ISP period embedded as an active member of the Nutag Partners team in order to glean an inside view of the social elements restoration process. I was based out of the Nutag Partners office in downtown Ulaanbaatar. There, I participated in project meetings and observed the discourse of the workday.

In April and May 2015, I attended several meetings that were held in Tunkhel to assess the social and ecological status of the study area, develop objectives, and exchange knowledge with community members and government officials.

The first meeting, held on April 29, involved open dialogue among government officials, NGO specialists, and community members. This meeting was an opportunity for stakeholders to voice their concerns and propose solutions. Five participants at this meeting identified themselves as “community members”. I conducted an in-depth interview with one community member following the meeting (see Appendix E). In the afternoon of April 29, I toured the project area to visually assess environmental conditions and characterize the site.

The primary purpose of the second trip to Tunkhel on May 11 was to mobilize members of the Tunkhel community for action in the project. Twelve individuals at the meeting – including community members and government individuals – were asked to complete an in-depth survey that probed for basic demographic information, specific concerns, observations/perceived drivers of environmental change, willingness to

contribute personally, satisfaction with associated institutions, and attitudes toward particular management actions (see Appendix C).

I submitted a questionnaire to be circulated throughout the ranks of the Tunkhel government (see Appendix D) on May 22. Three government officials responded to this questionnaire. These questionnaires were crafted in English and translated to Mongolian. Once returned the responses were translated back into English.

All verbal communications (meetings and interviews) in Tunkhel were conducted in Mongolian and verbally translated into English for me as they took place. Meetings were held in English at the Nutag Partners office. I took notes of all meeting dialogues. Several factors may have contributed to reduced information quality: fast-paced disorderly nature of community meetings, poor translation quality (vocabulary limitations, censorship, etc.), writing speed, etc.

Written surveys and interviews were first composed in English, translated into Mongolian, and distributed. The returned surveys and interviews were then translated back into English for analysis.

Information for site characterization relied upon a variety of information sources including satellite imagery, published research about the Kharaa River area, personal observations, photographs, input from other participants, and others.

# Results/Discussion

## Physical & Ecological Context

### Geopolitical Situation

The Kharaa River flows for a total of 291 km (181 mi) from source to mouth. It begins at the confluence of the Sögnögör River and the Mandal River (48°26′4″N 106°45′58″E) north of the Batsumber *soum* center in Töv *aimag*. It then proceeds north through hilly terrain into Selenge *aimag* where it passes through Tunkhel. It continues northwest through the Mandal *Soum* center, Züünkharaa, and the city of Darkhan before flowing into the Orkhon River in Orkhon *soum* of Darkhan-Uul aimag (49°37′30″N 105°50′30″E). The Kharaa River is within the Selenge River Basin, Lake Baikal's principle source, and part of the greater Yenisei River Basin which empties into the Arctic Ocean (Figure 1)


*Figure 1 The Yenisei River Basin in Mongolia and Russia*

Tunkhel (48°38'32"N 106°46'3"E) is a small village (pop. 3,748) situated in Mandal *soum* of Selenge *aimag* (Figure 2). It is located 156 km northeast of Mongolia's capital, Ulaanbaatar and 44 km SE from Züünkharaa. Tunkhel is situated on the east bank of the Kharaa River which flows north through the village.

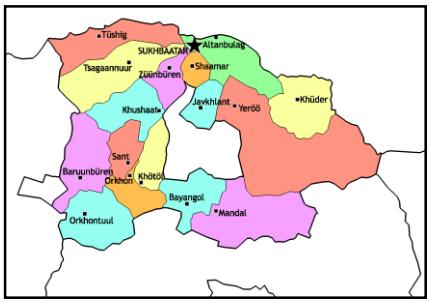


*Figure 2 The soums of Selenge aimag*

## Climate

Tunkhel has a Dwb climate classification according to the Köppen-Geiger system (Peel, Finlayson, & McMahon, 2007). The climate is characterized by warm summers and severely cold winters (Figure 3). The average annual temperature of Tunkhel is -0.6 °C. Seven months experience average temperatures above 0 °C. July has an average temperature of 19.1 °C, making it the warmest month. The coldest temperatures occur in January, when they average -24.6 °C.

Annual precipitation follows a unimodal pattern; the highest amount occurs in June, July, and August (Figure 4). The greatest amount of precipitation falls in July, with a monthly average of 74 mm. February is the driest month, with an average of only 2 mm. The annual average precipitation for the Tunkhel area is 267 mm.

| month | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 3 | 2 | 3 | 7 | 15 | 50 | 74 | 65 | 30 | 10 | 4 | 4 |
| °C | -24.6 | -20.7 | -8.1 | 3.0 | 11.3 | 17.1 | 19.1 | 17.1 | 9.9 | 0.8 | -11.1 | -21.3 |
| °C (min) | -30.6 | -28.2 | -15.6 | -4.4 | 3.3 | 9.9 | 12.8 | 11.1 | 2.8 | -6.4 | -17.8 | -27.3 |
| °C (max) | -18.5 | -13.2 | -0.5 | 10.5 | 19.3 | 24.4 | 25.4 | 23.1 | 17.1 | 8.1 | -4.3 | -15.3 |
| °F | -12.3 | -5.3 | 17.4 | 37.4 | 52.3 | 62.8 | 66.4 | 62.8 | 49.8 | 33.4 | 12.0 | -6.3 |
| °F (min) | -23.1 | -18.8 | 3.9 | 24.1 | 37.9 | 49.8 | 55.0 | 52.0 | 37.0 | 20.5 | -0.0 | -17.1 |
| °F (max) | -1.3 | 8.2 | 31.1 | 50.9 | 66.7 | 75.9 | 77.7 | 73.6 | 62.8 | 46.6 | 24.3 | 4.5 |

*Figure 3 Climate table of monthly average temperatures and precipitation for Zuunkharaa, Mongolia (from http://en.climate-data.org)*

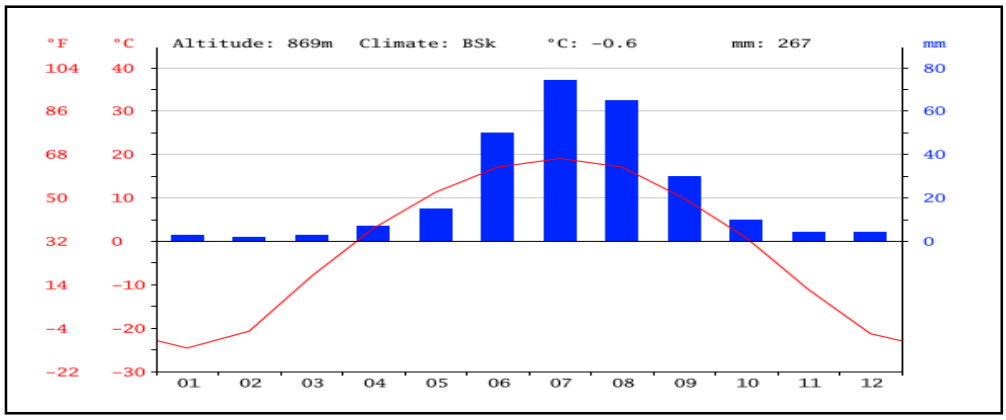


*Figure 4 Climatograph of monthly average temperatures and precipitation for Zuunkharaa, Mongolia (from http://en.climate-data.org*

## Topography, Hydrology, & Geomorphology

*Figure 5 Satellite imagery of the Kharaa River, floodplain, and uplands (Maps, 2015)*

The landscape of north central Mongolia is characterized by two major landscape types: “Boroogol terrain” and “Dzuun Mod” terrain. Boroogol terrain is of gentle relief with rolling hills and an average elevation of 1,200 MASL. Dzuun Mod terrain is characterized by rolling to steep mountains with an average elevation of 1,300 MASL. Solifluction (permafrost creep) is common in both terrain types (Hendry, Roscoe, & Ross, 2006).

*Figure 6 Soil profile from a cut-bank adjacent to the Kharaa River*

Elevations in the Tunkhel area range from 950 MASL at the Kharaa River Valley bottom to over 1,700 MASL atop the highest summits. The Kharaa River has cleared a relatively wide, flat-bottomed valley through the surrounding hilly terrain. Narrow, steep-sided valleys flank the Kharaa

River Valley and contribute alluvium to the floodplain. Truncated hills constrain the river channel on both sides. The reach of the Kharaa River north of Tunkhel displays characteristics of a wandering channel type: low gradient, moderate channel stability, medium sediment grain size, and low sediment supply (Hogan & Luzi, 2010). Satellite imagery indicates historic lateral channel movement (Figure 5). Profiles of eroded stream banks poorly sorted, coarse alluvium that are indicative of previous high-flow events (Figure 6).

### Soil

A 2008 soil survey of the Kharaa River Basin (Batkhishig & Iderjavhklhan, 2012) found the following soil types in the floodplains (Table 1):

*Table 1 Floodplain soils of the Kharaa River Basin*

| FAO Soil Classification | Mongolian Soil Classification |
|---|---|
| Fluvisols | Alluvial meadow derno |
| Salic fluvisols | Alluvial meadow salty |
| Fluvisols | Alluvial meadow stepped |

Soil quality in and around the CBRMPI is at risk of being impaired. Priess et al. conducted research on the effects of agricultural land-use on soil erosion in the Kharaa River Basin (2015). Of the Kharaa River Basin they claim, “Results clearly indicate that ongoing and expected near future changes in the agricultural sector mostly will cause considerable increases in soil losses both on croplands and in the steppe used for grazing confirming [reports of] soil degradation and losses in steppe biomass due to intensified grazing.” Furthermore, they acknowledge that current grazing and cultivation practices cause considerable soil and nutrient losses from the soil. Given current land use practices and anticipated future trends, soil loss is expected to accelerate in the Kharaa River Basin.

Community members have expressed concern regarding melting permafrost in the pastures. They claim that overgrazing is resulting in

the removal of insulative plant litter from the soil surface. With less plant residue to protect the soil surface from solar radiation, soil temperatures warm more quickly causing permafrost to melt. Evidence of erosion and permafrost melting were observed during the field trip on April 29 (Figure 7).

*Figure 7 Erosion of upland pasture soils near the Kharaa River. Photo taken 5/11/15*

## Water

Water quality is commonly cited as a major problem with the Kharaa River by the Tunkhel government and community members yet indicators and/or contaminants were not specified by these individuals. Water quality in the Kharaa River Basin has been studied extensively (Hofmann, Venohr, Behrendt, & Opitz, 2010; Hofmann, Hürdler, Ibisch, Schaeffer, & Borchardt, 2011; Hartwig, Theuring, Rode, & Borchardt, 2012; Hormann, Rode, & Theuring, 2013; Priess, Schweitzer, Batkhishig, Koschitzki, & Wurbs, 2015). These studies highlight concerns over mining and intensified agricultural activity in the Kharaa River Basin. Unusually high levels of arsenic were found just downstream of the Gatsuurt Mine near Tunkhel (Hofmann, Venohr, Behrendt, & Opitz, 2010).

### Vegetation

The surrounding uplands consist of forests, grasslands, and shrublands. North and east-facing slopes are predominately forested with larch, birch, and pine (for preliminary species list see Appendix A). The riparian meadow is home to a host of flora including fruit-bearing trees, willows and a diversity of grasses and forbs. The banks of the Kharaa River lack significant coverage from overhanging vegetation. There appears to be a scarcity of young woody vegetation within the project site. Community members attribute this to excessive grazing that has excluded recruitment of young plants (Community Scoping Meeting, 2015). Tunkhel residents have noticed decreases in berry yields from fruit trees over the years (Workshop Meeting, 2015).

*Figure 8 Pasture conditions along the Kharaa River, north of Tunkhel. Photo taken 5/11/2015*

## Land Uses

### Grazing

Grazing is one of the principal land uses in the Tunkhel area. Since the collapse of the logging industry in 1991, the residents of Tunkhel have become more dependent upon livestock to sustain their livelihoods (Community Scoping Meeting, 2015). Today, over 300 of

Tunkhel's 901 households own livestock (Workshop Meeting, 2015). Today, the cattle owned by village-based herders graze the Kharaa River's riparian meadows continuously (year-round). Previously, Tunkhel's livestock-owning households hired herders to herd their cattle collectively. This practice has since broken down because increasing numbers of cattle made collective herding unfeasible, according to community members (Community Scoping Meeting, 2015). Additionally, nomadic households pasture their large, multi-species herds in the surrounding countryside. These herders typically utilize upland pastures away from the meadows of the Kharaa River.

### Farming

As Mongolia's national policies continue to emphasize greater independence from food imports, farming will continue to intensify in the Kharaa River Basin. There are several farms and orchards immediately downstream of the conservation area. Water quality and soil loss concerns are further exacerbated by the potential for intensified agriculture (Priess, Schweitzer, Batkhishig, Koschitzki, & Wurbs, 2015). If a herder's livestock trespasses onto farmed land, the owner is required to compensate farmers for their losses.

### Logging

Prior to 1991, Tunkhel had the status of a "forestry village." Historically, state-owned companies performed logging operations in the surrounding forests. According to Gankhuyag, a forest engineer/economist by training, the Tunkhel logging industry processed 138 thousand cubic meters of timber per year and employed 250 to 500 workers during the socialist era (Personal Communication, 2015). Logging operations have scaled back significantly since this time and now much of the area's timber harvest is conducted illegally. This shift has caused village residents to rely heavily on grazing livestock for their livelihoods.

There is evidence of widespread logging throughout the forested uplands. Clear cutting does not seem to be a common practice; rather, it appears as though selective harvest is employed.

### Commercial Mining

The Gatsuurt Mine is an open-pit gold mine owned by the Canadian mining company, Centerra Gold. It is considered by Mongolian law a mineral deposit of strategic importance and therefore can proceed with operations under the Water and Forest Law. The oxide and refractory ore it produces are processed at the nearby Boroo Gold Mine facility. The mine is located upstream of Tunkhel within a tributary catchment of the Kharaa River. It is situated on Noyon Mountain, a site of historical significance where Khunnu-era tombs have been found (Bold-Erdene, 2014). In early September 2007, Gatsuurt was targeted by environmental activists who opened fire on mining equipment at the site (Jacob, 2010).

### Gravel Quarrying

Historically, gravel has been extracted from several small, shallow pits adjacent to the Kharaa River. At least two open pits are located within the project area and an additional abandoned pit is located just upstream of the project area. Unlicensed gravel extraction is unlawful but the town governor does have the authority to grant permission to locals for personal use (Community Scoping Meeting, 2015).

### Railroad

The Trans-Mongolian Railway that passes through Ulaanbaatar and connects Beijing to the Trans-Siberian Railway runs along the Kharaa River and through Tunkhel. The railway in Tunkhel carries domestic trains that connect Ulaanbaatar, Darkhan, Sukhbaatar, Erdenet, Zamyn- Üüd, Choir, and Sainshand. The area protected by the CBRMPI will be located between the 264 and 274 km stops along the railroad. Given Tunkhel's location on the railroad connecting some Mongolia's most populous areas, the presence of the railroad can be advantageous for encouraging tourism to Tunkhel and generating

publicity for the CBRMPI. The railroad runs along the far eastern side of the valley bottom along the Kharaa River and is separated from the pasture by barbed wire fence.

### Roads and Vehicle Use

A network of unofficial, unpaved roads traverse through the Kharaa River Meadow. These roads receive relatively little traffic and are used by locals. Vehicle use on the Kharaa River Meadow can contribute to soil compaction, erosion, chemical pollution, vegetation loss, riverbank failure and other environmental damage.

## Social Context

Residents of Tunkhel and the surrounding area are a key stakeholder group for the successful implementation of the Conservation Plan. As a community-based initiative, the project relies heavily on the support and input of local community members.

### Background

The population of Tunkhel Village is approximately 3,700. Nearly 40% of the Village's 901 households have livestock (Workshop Meeting, 2015). Most village-based herders have small herds of cattle (3-5 head) that are pastured on the meadows adjacent the Kharaa River year-round. Approximately 600 cattle live in town, of which an estimated 50% are female (Workshop Meeting, 2015). Village-based herders use their cows for the production of a variety of dairy products that are consumed locally and sold to buyers in nearby Ulaanbaatar. In addition to livestock grazing, locals use portions of the Kharaa River Valley for crop production.

### Concerns

The community members that attended the two initial meetings expressed their concerns about the degradation of the riparian meadow and the Kharaa River as well as potential drivers of the observed changes (Figure 9). The community members cited decreased forage (grasses), pollution, declining plant diversity, reduced pasture area, melting permafrost, fewer berries and fruits, and the loss

of black alder and willow as evidence of riparian pasture degradation along the Kharaa River. Additionally, they are concerned about the health of the Kharaa River. Observations of lower water levels, polluted/unclean water, declining fish populations, foul odors, and fewer springs were put forth as indicators of water degradation. Proposed causes for such changes are largely attributed to anthropogenic drivers such as pollution, deforestation, mining/irresponsible companies, poor enforcement, inadequate monitoring, increased livestock numbers, and overgrazing of riparian willows. Additionally, consideration was given to the influence of environmental drivers such as ecological disturbance and lack of precipitation.

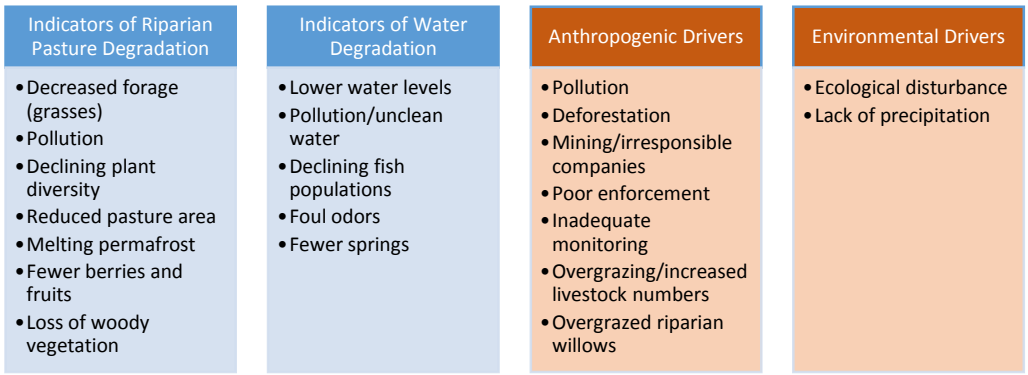


*Figure 9 Tunkhel Community's Knowledge of Indicators and Drivers of Resource Degradation*

From the discourse of the two initial meetings, Nutag Partners has identified four primary areas of concern that are within the project's scope:

1. Lack of rangeland ecosystem knowledge among community members
2. Pasture degradation
3. Tree damage
4. Soil erosion and degraded water quality

## Knowledge of Policy

The handful of community members who attended either of the two initial planning meetings are well-informed regarding the nature of the

issues and the proposed management actions, but at this point, it is difficult to determine project awareness beyond this small group of concerned community members. During the May 11 meeting, several individuals expressed concern over the lack of greater community involvement. Participants attributed the low attendance levels to a breakdown of communication between meeting planners and village residents (a power outage in Tunkhel on May 11 may have further hampered communication). Given the CBRMPI's collaborative nature, future meetings and events should give special consideration to overcoming barriers to communication and seek greater involvement from all stakeholders.

| Management Action | Individuals who agree or strongly agree |
|---|---|
| *Designating a 10 km stretch of the Kharaa River as a* ***Conservation Area*** | **10 of 11** |
| *The implementation of a* ***green forage cultivation program*** | **8 of 9** |
| *The development of designated* ***campgrounds*** | **7 of 8** |
| *Establishing a* ***monitoring program*** *to determine the effects of management actions* | **10 of 10** |
| ***Regulating grazing*** *in the Kharaa River pasture* | **10 of 10** |
| *Taking actions to* ***increase tourism*** *to the Tunkhel area* | **10 of 10** |

*Figure 10 May 11 Meeting Participant's Attitudes toward Proposed Management Actions*

## Position on Policy

As per the survey results and general observations, community members who have participated in the CBRMPI meetings thus far strongly support the management actions proposed in the Conservation Plan (Figure 10). Additionally, they indicated that they are willing to participate in the implementation of the proposed actions (Figure 11). The prevailing attitudes of the Tunkhel community toward the CBRMPI is a highly relevant uncertainty. The community members at the two initial meetings indicated that many other community members lack interest in protecting nature. They explained that many local herders fail to recognize how overgrazing can destroy the pasture and do not consider the potential for alternative land uses such as

berry production and green forage harvesting. In the two initial meetings, community members requested that Nutag Partners facilitate a herder awareness campaign to communicate the consequences of overgrazing.

Further scoping should be directed at understanding and communicating the attitudes of the greater Tunkhel community toward the establishment of a Conservation Area and associated resource management actions. (Note: these survey results should only be used to gauge the interest of the small group that attended the May 11 meeting and are not representative of the attitudes and concerns of the greater population of Tunkhel).

| Involvement Statement | Individuals who agree or strongly agree |
|---|---|
| *I am willing to assist with **implementing a conservation plan** to protect the Kharaa River and riparian meadows* | **10 of 10** |
| *I am willing to assist with the **green forage cultivation program*** | **8 of 9** |
| *I am willing to assist with **constructing and maintaining campgrounds*** | **8 of 8** |
| *I intend to be actively involved in the **project planning process*** | **10 of 10** |
| *I intend to be actively involved in the **maintenance and monitoring** of the Conservation Area* | **10 of 10** |

*Figure 11. May 11 Meeting Participant's Stated Willingness to Participate in Project Activities*

## Advantages

The creation of a Conservation Area along a 10 km stretch of the Kharaa River and associated stewardship projects can be very advantageous for the Tunkhel community. The community members that have been involved in the planning process thus far recognize the connection between environmental conditions and the livelihoods of local people. Because of the collaborative and participatory nature of the CBRMPI, management actions will be directed at addressing the community member's specific concerns. Consideration should be given to recognizing and addressing the diverse needs and interests of the community as a whole, not solely those of an active, vocal minority. If the CBRMPI succeeds, it will result in the enhanced provision of

ecosystem services that support and sustain the livelihood of the local community (Figure 12; Figure 13). The creation of a Locally Protected Area will establish a governing framework to coordinate community-based conservation efforts and regulate resource use.

| *Ecosystem service* | *Ecosystem functions* | *Local example* |
|---|---|---|
| *Water regulation* | Regulation of hydrological flows. | Riparian vegetation and soils |
| *Water supply* | Storage and retention of water. | Riparian vegetation and soils |
| *Food production* | That portion of gross primary production extractable as food. | Farming and fruit production |
| *Waste treatment* | Recovery of mobile nutrients and removal or breakdown of excess or xenic nutrients and compounds. | Decomposition of animal waste |
| *Raw materials* | That portion of gross primary production extractable as raw materials. | Production of forage for livestock |
| *Recreation* | Providing opportunities for recreational activities. | Campsites |
| *Cultural* | Providing opportunities for non-commercial uses. | Community events |

*Figure 12 Ecosystem Services Addressed by the Conservation Plan (Costanza, et al., 1997)*

The community members in attendance at the two previous meetings expressed a strong interest in cultivating supplemental livestock fodder and protecting stands of berry trees along the riparian corridor. Dedicating an area to green forage cultivation can be advantageous: such an area can serve as a reserve fodder source during times of shortage. A green forage cultivation area will also be protected from negative impacts of livestock (e.g. trampling, browsing of woody vegetation, etc.). The local community can also benefit from the protection of the riparian forests. These forests are important sources of berries and other products. They are threatened by overgrazing from cattle. There is debate among community members about whether woody vegetation along the riparian corridor decreases forage production.

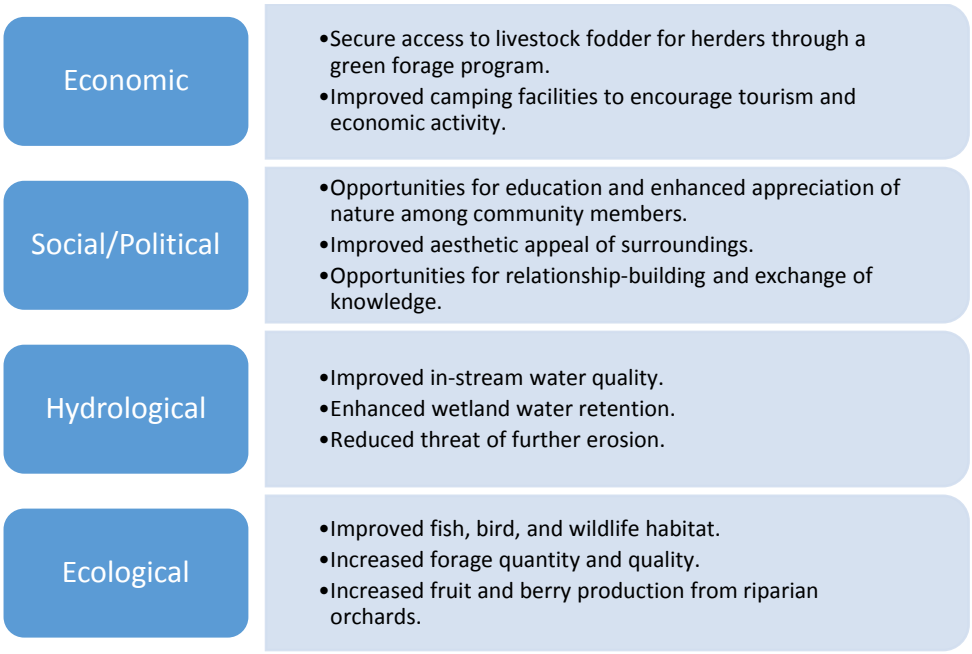


*Figure 13. Potential economic, social/political, hydrological, and ecological benefits of riparian conservation for the Tunkhel community*

## Disadvantages

Potential disadvantages of the CBRMPI for community members are worth careful consideration. Given the contribution of village-based livestock to the degraded pasture conditions, it is likely that further grazing in the future Conservation Area will have to be regulated and/or coordinated. Although the specifics of a grazing plan are not yet determined, solutions may require herders to control herd movement (e.g. herding or fencing), reduce herd size, graze alternative pastures, acquire feed from external sources, consolidate livestock into shared herds, etc. Additionally, some activities may be excluded from the Conservation Area depending on what regulations that are agreed upon.

Village-based herders prefer their cows to be pastured nearby so they can milk them on a regular basis. If grazing is restricted along the Kharaa River Meadow and herders are forced to pasture their cows elsewhere, herders will have less access to milk. Therefore, herders may resist solutions that would require cows to be moved elsewhere.

## Conclusions

One ever-present challenge for community-based natural resource management is stakeholder involvement. Drawing from a diversity of stakeholders allows for the incorporation of knowledge sources but such approaches depend heavily on community support and are therefore exceptionally vulnerable to failure from lack of participation. Tunkhel's employment officer, considers stakeholder awareness the biggest obstacle to the success of the CBRMPI. The local forest engineer echoed the importance of community involvement she said, "The success of the project relies upon the views of the community members". Thus far, attempts to increase community awareness have yielded modest results. Participants in the May 11 meeting acknowledged that more community members need to be reached and recruited (Workshop Meeting, 2015).

Nutag Partners are serving a facilitatory role in the CBRMPI; the Tunkhel community has the power to determine project objectives and management actions. The intent of this bottom-up approach to resource management is to empower and encourage responsibility among community members. Associated with such an approach is the potential risk of conflicting stakeholder interests. Although there was nearly consensus among a small sample of community members regarding policy agreement and personal willingness to support, those were simply the views of what are likely the most concerned community members in Tunkhel. CBRMPI policy can be further complicated in the future when additional stakeholders – especially those who aren't in favor of proposed policies – become involved.

The CBRMPI's success may also be limited by potentially conflicting goals. As the terms of the GEF grant state, the CBRMPI is both a capacity development project and a biodiversity protection project. Ideally, both purposes would be satisfied without sacrificing the other but there is uncertainty about the feasibility of such an outcome. Nonetheless, it is understood that current land use practices on the

Kharaa River pastures have contributed to degraded resource conditions which are, in turn, affecting local livelihoods. Despite the potential for conflict in prioritizing environmental health over community development (or vice versa), incorporating both goals into the project ensures that social and ecological elements of the system are recognized and addressed.

One critique of collaborative approaches to natural resource management is the inefficiency of multi-party decision making processes. Time demands placed on stakeholders can be costly; collaborators should make an effort work efficiently and deliberately. A local government official recognizes that project success will require patience and commitment: “The work can’t be done in one day. Therefore, the research team should work with community members to understand their interests”. Unfortunately, availability of time and financial resources will inevitably constrain opportunities for knowledge sharing and trust building. All stakeholders must take advantage of every opportunity to strengthen relationships and share knowledge.

As indicated in the May 11 survey, community members are concerned about the potential for restricted access to the riparian pasture and conflict over natural resources (Workshop Meeting, 2015). Therefore, it behooves planners to ensure that the CBRMPI will ensure secure herder access to pasture and provide mechanisms to reduce and mitigate resource conflicts.

Negatives associated with the CBRMPI as perceived by local community members can reduce stakeholder buy-in. Failure to communicate a vision for and/or to produce a landscape that is considered valuable by the members of the Tunkhel community can undermine local support, thereby hampering project success. This potential issue can be addressed by education directed at communicating the value of the ecosystem services provided by the Kharaa River and adjacent meadow.

Additionally, unmitigated contradicting objectives can undermine project success of multi-objective projects such as this. A plan that provides for pasture access to all village-based herders while also resulting in improved riparian conditions would be ideal, but the feasibility of such an outcome is currently uncertain. Successful solutions will accurately identify site-specific drivers of ecosystem degradation and reduce or eliminate the effects of the driver(s). Since ecosystem processes are non-linear and simply removing the source of degradation may not guarantee recovery, active intervention may also be necessary to restore an ecosystem toward a desired state (Briske, Fuhlendorf, & Smeins, 2003). Rangelands can remain in degraded conditions even if grazers are excluded from the system (Laycock, 1991; Friedel, 1991; Briske, Fuhlendorf, & Smeins, 2003). In fact, studies have shown that pasture conditions can improve in the presence of livestock when grazing strategies account for site-specific conditions and processes (Havstad, 1994).

Ecosystems must be studied and managed with consideration for the role and nature of disturbance (i.e. timing, seasonality, duration, intensity, severity, extent, and spatial distribution). Disturbance is inherent to river systems. The dynamicity of river systems is especially relevant: managers must consider the lateral, longitudinal, vertical, and temporal dimensions at play in order to adequately characterize and manage rivers systems. Failure to do so can severely impede project success.

According to Houdret et al., “the 2011 Budget Law and the 2012 Water Law provide for a fiscal strengthening of local governments and clearer sharing of responsibilities among the various different institutions involved in water management” (2014). It is under this legal framework that integrated watershed management has been institutionalized in the form of River Basin Councils (RBCs). The Kharaa River Basin Council was established in 2012. Community members and local government officials have claimed that the Kharaa RBC has done little to exercise its authority thus far (Community Scoping Meeting, 2015).

The work of both the Kharaa RBC and the CBRMPI can be mutually supported by cross-scale collaboration aimed at integrating goals and resources.

## Recommendations

Outlined below are brief recommendations for the three principle stakeholder groups in the CBRMPI – Nutag Partners, Tunkhel community members, and Tunkhel government.

Recommendations for Nutag Partners:

- Distribute educational materials throughout community to increase project awareness and solicit committed involvement.
- Facilitate “reflection sessions” before, during, and after projects with community members and government officials to encourage appreciation of resource stewardship, develop trust, and identify solutions/common interests.
- Establish connections with the Kharaa River Basin Authority to coordinate Conservation Plan with River Basin Plan.
- Communicate the value of ecosystem services provided by the Kharaa River and adjacent wetlands.
- Utilize technical resources for riparian management (see Appendix B).

Recommendations for Tunkhel community members:

- Take advantage of provisions in the Law on the Environment to organize and enter into contracts with local government.
- Delegate project maintenance tasks to committed individuals/groups (keep an official record of responsibilities and scheduled activities).
- Seek opportunities to gain knowledge about surrounding ecosystem.
- Remain engaged and active in the policy negotiation process.

Recommendations for Tunkhel government officials:

- Communicate a sense of urgency and need for immediate mobilization to community members.
- Continually field feedback from community members.
- Encourage volunteerism in the Tunkhel community.
- Mitigate risk of unequal community commitment.
- Ensure that the final Conservation Plan is accessible to community members.
- Seek sustained, long-term project funding and support.

# References


Addison, J., Davies, J., Friedel, M., & Brown, C. (2013). Do pasture user groups lead to improved rangeland conditions in the Gobi Desert? *Journal of Arid Envrionments, 94*, 37-46.

Angerer, J., Han, G., Fujisaki, I., & Havstad, K. (2008). Climate Change and Ecosystems of Asia with Emphasis on Inner Mongolia and Mongolia. *Rangelands*, 46-51.

Arnold, J., & Fernandez-Gimenez, M. E. (2008). Engaging communities through participatory research. In E. Donoqhue, & V. Surtevant, *Forest Community Connections: Implications for Research. Management and Governance.* Washington D.C.: Resources for the Future.

Baker, S., & Eckerberg, K. (2013). A Policy Analysis Perspective on Ecological Restoration. *Ecology and Society, 18*(2).

Batkhishig, B., & Reid, R. (2009, April 14-17). Linking knowledge and action through participatory research. Beijing.

Batkhishig, O., & Iderjavhklhan, S. (2012, February). Soil mapping of Mongolia.

Bold-Erdene, S. (2014, December 2). *Landmark agreement on Gatsuurt in the offing.* Retrieved from Mongolian Mining Journal: http://en.mongolianminingjournal.com/content/58187.shtml

Briske, D. D., Fuhlendorf, S. D., & Smeins, F. E. (2003). Vegetation dynamics on rangelands: a critique of current paradigms. *Journal of Applied Ecology, 40*(4), 601-614.

Brooks, N. (2003). *Vulnerability, Risk, and Adaptation: A Conceptual Framework.* Norwich: Tyndall Centre for Climate Change Research.

Caparrós, A. (2011). *Environment and Natural Resource Management Socio-economic Survey for Mongolia (ENRMSS 2010) Mongolia Discussion Papers.* World Bank, East Asia and Pacific Sustainable Developement Department, Washington, D.C.

Cash, D. W. (2003). Innovative Natural Resource Management. *Environment, 45*(10), 8-20.

Dagvadorj, D., Natsadorj, L., Dorjpurev, J., & Namkhainyam, B. (2009). *Mongolia: Assessment Report on Climate Change.* Ulaanbaatar: Ministry of Environment, Nature and Tourism.

Eckert, S., Hüsler, F., Liniger, H., & Hodel, E. (2015). Trend Analysis of MODIS NDVI time series for detecting land degradation and regeneration in Mongolia. *Journal of Arid Environments, 113*, 16-28.

Fernandez-Gimenez, M. E. (2001). The Effects of Livestock Privatization on Pastoral Land Use and Land Tenure in Post-Socialist Mongolia. *Nomadic Peoples, 5*(2), 49-66.

Fernandez-Gimenez, M. E., & Allen-Diaz, B. (1999). Testing a non-equilibrium model of rangeland vegetation dynamics in Mongolia. *Journal of Applied Ecology, 36*(6), 871-885.

Fernandez-Gimenez, M. E., & Batbuyan, B. (2004). Law and Disorder: Local Implementation of Mongolia's Land Law. *Development and Change*, 141-165.

Fernandez-Gimenez, M. E., & Batbuyan, B. (2004). Law and Disorder: Local Implementation of Mongolia's Land Law. *Development and Change, 35*(1), 141-165.

Fernandez-Gimenez, M. E., Batkhishig, B., & Batbuyan, B. (2012). Cross-boundary and cross-level dynamics increase vulnerability to severe winter disasters (dzud) in Mongolia. *Global Environmental Change-Human and Policy Dimensions, 22*(4), 836-851.

Fernandez-Gimenez, M. E., Batkhishig, B., Batbuyan, B., & Ulambayar, T. (2015). Lessons from the Dzud: Community-Based Rangeland Management Increases the Adaptive Capacity of Mongolian Herders to Winter Disasters. *World Development, 68*, 48-65.

Fisher, B., Turner, R. K., & Morling, P. (2009). Defining and classifying ecosystem services for decision making. *Ecological Economics, 68*(3), 643-653.

Friedel, M. H. (1991). Range Condition Assessment and the Concept of Thresholds - A Viewpoint. *Journal of Range Management, 44*(5), 422-426.

Galvin, K. A. (2009). Transitions: Pastoralists Living with Change. *Annual Review of Anthropology, 38*, 185-198.

Gibson, C. C., & Marks, S. A. (1995). Transforming Rural Hunters into Conservationists: An Assessment of Community-Based Wildlife Management Programs in Africa. *World Development, 23*(6), 941-957.

Hartwig, M., Theuring, P., Rode, M., & Borchardt, D. (2012). Suspended sediments in the Kharaa River cathment (Mongolia) and its impact on hyporeheic zone functions. *Environ. Earth Sci., 65*, 1535-1546.

Havstad, K. M. (1994). Shee Grazing as a Range Improvement Tool. *Sheep Research Journal, 10*(1), 72-78.

Hendry, J. W., Roscoe, W. E., & Ross, D. A. (2006). *Technical Report on th Gatsuurt Gold Project, Northern Mongolia.* Toronto: Roscoe Postle Associates Inc.

Higgs, E. S. (1997). What is Good Ecological Restoration? *Society for Conservation Biology, 11*(2), 338-348.

Hilker, T., Natsadorj, E., Waring, R. H., Lyapustin, A., & Wang, Y. (2014). Satellite observed widespread decline in Mongolian grasslands largely due to overgrazing. *Glob. Change Biol., 20*, 418-428.

Hobbs, R. J., & Harris, J. A. (2001). Restortion Ecology: Repairing the Earth's Ecosystems in the New Millennium. *Restoration Ecology, 9*(2), 239-246.

Hofmann, J., Hürdler, J., Ibisch, R., Schaeffer, M., & Borchardt, D. (2011). Analysis of Recent Nutrient Emission Pathways, Resulting Surface Water Quality and Ecological Impacts under Extreme Continental Climate: The Kharaa River Basin (Mongolia). *Internat. Rev. Hydrobiol., 96*, 484-519.

Hofmann, J., Venohr, M., Behrendt, H., & Opitz, D. (2010). Integrated water resources management in central Asia: nutrient and heavy metal emissions and thei relevance for the Kharaa River Basin, Mongolia. *Water Science and Technology, 62*(2), 353-363.

Hogan, D. L., & Luzi, D. S. (2010). Channel Geomorphology: Fluvial Forms, Processes, and Forest Management Effects. In R. G. Pike, T. E. Redding, R. D. Moore, R. D. Winkler, & K. D. Bladon (Eds.), *Compendium of forest hydrology and geomorphology in British Columbia* (pp. 331-371). BC: B.C. Ministry of Forests and Range and FORREX Forum for Research.

Hormann, J., Rode, M., & Theuring, P. (2013). Recent developments in river water quality in a typical Mongolian river basin, the Kharaa case study. *Proceedings of H04, IAHS-IAPSO-IASPEI Assembly* (pp. 123-131). Gothenburg, Sweden: IAHS.

Houdret, A., Dombrowsky, I., & Horlemann, L. (2014). The institutionalization of River Basin Management as politics of scale - Insights from Mongolia. *Journal of Hydrology, 519*(C), 2392-2404.

Inam, E., Khantotong, S., Kim, K.-W., Tumendemberel, B., Erdenetsetseg, S., & Puntsag, T. (2011). Geochemical distribution of trace element concentrations in the vicinity of Boroo gold mine, Selenge Provine, Mongolia. *Environmental Geochemistry and Health, 33*, 57-69.

Jacob, P. (2010, October 13). *Mongolia: Eco-Warriors Call Attention to Economic Development Dilemma*. Retrieved from EURASIANET.org: http://www.eurasianet.org/node/62142

Janzen, J., Priester, M., Chinbat, V., & Battsengel, V. (2007). *Artisanal and Small-Scale Mining in Mongolia.* Ulaanbaatar: Faculty of Earth Sciences, National University of Mongolia, Center for Development Research.

Khishigbayar, J., Fernandez-Gimenez, M. E., Angerer, J. P., Reid, R. S., Chantsallkham, J., Baasandorj, Y., & Zumberelmaa, D. (2015). Mongolian rangelands at a tipping point? Biomass and cover are stable but composition shifts and richness declines after 20 years of grazing and increasing temperatures. *Journal of Arid Environments, 115*, 100-112.

Laycock, W. A. (1991). Stable states and thresholds of range condition in North American rangelands: A viewpoint. *Journal of Range Management, 44*(5), 427-433.

Leisher, C., Hess, S., Boucher, T. M., van Beukering, P., & Sanjayan, M. (2012). Measuring the Impacts of Community-based Grasslands Management in Mongolia's Gobi. *PLOS ONE, 7*(2), e30991.

Maps, G. (2015). Kharaa River. Retrieved from https://www.google.mn/maps/@48.7042525,106.7290753,3465m/data=!3m1!1e3

Mehta, J. N., & Kellert, S. R. (1998). Local attitudes toward community-based conservation policy and programmes in Nepal: a case study in the Makalu-Barun Conservation Area. *Environmental Conservation, 25*(4), 320-333.

Nandintsetseg, B., & Shinoda, M. (2013). Assessment of drought frequency, duration, and severity and its impacts on pasture production in Mongolia. *Nat. Hazards, 66*, 995-1008.

Peel, M. C., Finlayson, B. L., & McMahon, T. A. (2007). Updated world map of the Köppen-Geiger climate classification. *Hydrol. Earth Syst. Sci., 11*, 1633-1644.

Priess, J. A., Schweitzer, C., Batkhishig, O., Koschitzki, T., & Wurbs, D. (2015). Impacts of agricultural land-use dynamics on erosion risks and options for land and water management in Northern Mongolia. *Environmental Earth Science*, 697-708.

Reading, R. P., Johnstad, M. D., Batjargal, Z., Amgalanbaatar, S., & Mix, H. M. (1999). Expanding Mongolia's system of protected areas. *Natural Areas Journal, 19*(3), 211-222.

Reason, P., & Bradbury, H. (2001). Introduction: Inquiry and Participation in Search of a World Worth of Human Aspiration. In P. Reason, & H. Bradbury, *The Handbook of Action Research* (pp. 1-14). London/Thousand Oaks, CA: Sage.

Rudeen, A. K., Fernandez-Gimenez, M. E., Jessica, L. T., & Meiman, P. (2012). Perceptions of Success and the Question of Consensus in Natural Resource Collaboration: Lessons from an Inactive Collaborative Group. *Society & Natural Resources: An International Journal, 25*, 1012-1027.

Shabb, D., Chitnis, N., Baljinnyam, Z., Saagii, S., & Zinsstag, J. (2013). A mathematical model of the dynamics of Mongolian livestock populations. *Livestock Science, 157*(1), 208-288.

Society for Ecological Restoration. (2004). *SER International primer on ecological restoration.* Retrieved from SER: http://www.ser.org/resources/resources-detail-view/ser-international-primer-on-ecological-restoration

Sundig, K. N. (2011). Toward an Era of Restoration in Ecology: Successes, Failures, and Opportunities Ahead. *Annual Review of Ecology, Evolution, and Systematics, 42*, 465-487.

Takehiko, I. Y., Lhagvasuren, B., Tsunekawa, A., Shinoda, M., Takatsuki, S., Buuveibaatar, B., & Chimeddorj, B. (2013). Fragmentation of the Habitat of Wild Ungulates by Anthropogenic Barriers in Mongolia. *PLOS ONE, 8*(2).

The Asia Foundation. (2009). *Land reclamation a Mongolian citizen's guide.* Retrieved Mar 9, 2015, from http://www.sgpmongolia.org/upload/Land reclamation.pdf

Tsogtbaatar, J. (2004). Deforestation and reforestation needs in Mongolia. *Forest Ecology and Management, 201*(1), 57-63.

Warner, J., Wester, P., & Bolding, A. (2008). Going with the flow: river basins as natural units for water management? *Water Policy, 10*(2), 121-138.

Wilson, E. O. (1992). *The Diversity of Life.* New York: Norton.

Worrell, R., & Appleby, M. C. (2000). Stewardship of natural resources: Definition, ethical and practical aspects. *Journal of Agricultural & Environmental Ethics, 12*(3), 263-277.

# Appendices

## Appendix A: Local Species Lists

These two species lists of upland and riparian vegetation can be used for future development of an official species list of the Conservation Area to assist with biological monitoring.

### Upland

| *Habit* | *Scientific name* | *English Name* | *Mongolian Name* |
|---|---|---|---|
| *Tree* | *Pinus sylvestris* | Scots Pine | Нарс |
| | *Betula platyphylla* | Japanese White Birch | Хус |
| | *Pinus sibirica* | Siberian pine | Сибирийн нарс |
| | *Larix sibirica* | Siberian larch | Хар мод |
| *Shrub* | *Ribes nigrum* | Blackcurrant | Хар улаагана |
| | *Rhododendron daburicum* | Rhododendron | Дагуур тэрэлж |
| *Forb* | *Valeriana officinalis* | Valerian | Цувраа навчит бамбай |
| | *Utrica dioica* | Stinging nettle | Хоёр оронт халгай |
| | *Thermopsis lanceolata* | Lanceleaf | Ланцуй тарваган шийр |
| | *Sanguinosorba officinalis* | Great burnet | Эмийн сөд |
| | *Tanacetum vulgare* | Common tansy | Марал цэцэг |
| | *Paeonia anomala* | Peony | Ягаан цээнэ |

## Riparian

| Habit | Scientific name | English Name | Mongolian Name |
|---|---|---|---|
| *Tree* | *Crataegus dahurica* | Hawthorn | |
| | *Prunus padus* | Hackberry | |
| | *Salix spp.* | | |
| *Shrub* | *Dasiphora fruticosa* | Shrubby cinquefoil | |
| | *Rosa dahurica* | Rose | |
| *Forb* | *Sanguinosorba officinalis* | Great burnet | Эмийн сөд |
| | *Scabiosa comosa* | Scabious | |
| | *Dianthus versicolor* | | |
| | *Echinops dahuricus* | | |
| | *Lillium tenuifolium* | | |
| | *Allium senescens* | | |
| | *Gentiana decumbens* | | |
| | *Galium verum* | | |
| | *Allium anisopodium* | | |
| | *Iris dichotoma* | | |
| | *Caragana microphylla* | | |
| | *Vicia amoena* | | |
| | *Astragalus adsurgens* | | |
| | *Trifolium lupinaster* | | |
| | *Melilotus dentatus* | | |
| | *Thermopsis dahurica* | | |
| | *Potentilla bifurca* | | |
| | *Chenopodium album* | | |
| | *Heteropappus hispidus* | | |
| | *Potentilla anserine* | | |
| | *Artemisia adamsii* | | |
| | *Potentilla acaulis* | | |
| *Grass* | *Achnatherum splendens* | | |
| | *Agropyron cristatum* | | |
| | *Cleistogenes squarrosa* | | |

*Hordeum brevisubulatum*

*Poa pratense*

*Bromus inermis*

*Alopecurus arundinaceus*

*Agrostis mongolica*

*Calamagrostis purpurea*

## Appendix B: Resources for Riparian Management and Monitoring

1. **Citizen Riparian Monitoring Protocol** (City of Austin Watershed Protection Department)
    - http://www.austintexas.gov/sites/default/files/files/Watershed/riparian/CitizenRiparianMonitoringProtocolv2.pdf
2. **Multiple Indicator Monitoring (MIM) of Stream Channels and Streamside Vegetation** Technical Reference 1737-23 (Bureau of Land Management)
    - http://www.blm.gov/nstc/library/pdf/MIM.pdf
3. **Bioengineering Techniques for Streambank Restoration** (Martin Donat)
    - http://www.env.gov.bc.ca/wld/documents/wrp/wrpr_2.pdf

## Appendix C: Community Member Survey

### Administered 5/11/2015 in Tunkhel Village

### Number of Respondents: 12

---

1. Age: _____

2. Gender: Male Female

3. Do you live in Tunkhel? YES NO

4. Are you a member of a herder group? YES NO

   If YES, what is it called?

   _____

5. Do you own livestock? YES NO

6. If you responded YES to question 5, please indicate how many animals of each species you own.

   Cattle: Yaks: Sheep: Goats: Horses:
   Other: _____

7. If you responded YES to question 5, is the Kharaa River meadow your primary pasture?

   YES NO

8. If you responded YES to question 5, do you use any pastures other than the Kharaa River meadow?

   YES NO

   If YES, please describe the location of the pasture:

_____

9. Have you observed any changes in the condition of the riverside pasture?

   YES NO

   A. If you responded "YES" to question 9, please describe the nature of these changes:

   B. If you responded "YES" to question 9, what do you think has caused these changes?

12. Have you observed any changes in the quality of the water in the Kharaa River?

   YES NO

   A. If you responded "YES" to question 1, please describe the nature of these changes:

   B. If you responded "YES" to question 1, what do you think has caused these changes?

15. How did you hear about today's meeting?

PRE-MEETING SURVEY

**Rate your level of concern regarding the following issues related to the Kharaa River (mark one box per line):**

| Issue | 1 - Not Concerned | 2 - Slightly Concerned | 3 - Moderately Concerned | 4 - Concerned | 5 - Very Concerned |
|---|---|---|---|---|---|
| 1. Decreased water quality of the Kharaa River | | | | | |
| 2. Decreased availability of forage for livestock in riparian pastures | | | | | |
| 3. Reduced quality of forage for livestock in riparian pastures | | | | | |
| 4. Restricted access to riparian pasture | | | | | |
| 5. Decreased riparian pasture productivity | | | | | |
| 6. Decreased biodiversity in the riparian pasture | | | | | |
| 7. Decreased tourism to the Tunkhel area | | | | | |
| 8. Potential for conflict over natural resources | | | | | |

9. Are any other issues of concern to you regarding the Kharaa River and associated natural resources?

**Rate your level of agreement to the following statements (mark one box per line):**

| Statement | 1 – Strongly Disagree | 2 – Disagree | 3 – Indifferent/ Undecided | 4 – Agree | 5 – Strongly Agree |
|---|---|---|---|---|---|
| 10. I am in favor of designating a 10 km stretch of the Kharaa River as a Conservation Area. | | | | | |
| 11. I am willing to assist with implementing a conservation plan to protect the Kharaa River and riparian meadows. | | | | | |
| 12. We should implement a green forage cultivation program. | | | | | |
| 13. I am willing to assist with a green forage cultivation program. | | | | | |
| 13. We should develop designated campgrounds (for tourist and local use). | | | | | |
| 14. I am willing to assist with constructing and maintaining campgrounds. | | | | | |
| 15. We should establish a monitoring program to determine the effects of management actions. | | | | | |
| 16. I intend to be actively involved in the project planning process. | | | | | |
| 17. I intend to be actively involved in the maintenance and monitoring of the Conservation Area. | | | | | |
| 18. I have a clear vision of how to improve the conditions of the Kharaa River and riparian meadows. | | | | | |
| 19. I feel like my potential to contribute to this project is valued. | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 20. I am satisfied with the local government's performance regarding this project. | | | | | |
| 21. I am satisfied with the contribution of NGO professionals and scientists to this project. | | | | | |
| 22. I am satisfied with the contributions from other community members to this project. | | | | | |
| 23. I am in favor of regulating grazing in the Kharaa River pasture. | | | | | |
| 24. I am in favor of taking actions to increase tourism to the Tunkhel area. | | | | | |

25. Do you have any additional concerns, comments, or questions?

## Appendix D: Government Official Survey

Submitted by email electronically on 5/22/2015

Number of respondents: 3

---

1. What are your job responsibilities?
2. What is your understanding of the development of the conservation (research) project?
3. I have heard that people in Tunkhel have been interested in a riparian conservation project like this for quite a while, do you know why the project took so long to get started?
4. Why are you interested in establishing a conservation area?
5. What environmental problems need to be addressed in the Tunkhel area?
6. What do you hope this project will accomplish?
7. Please describe the different stakeholders/groups who use the Kharaa River Pasture. What are their interests?
8. What has been done to get stakeholders involved?
9. What do you consider the biggest obstacles to the CP's success?
10. How can the results of this project be sustained into the future?
11. What assistance do you need in order to ensure project success?
12. What are the community member's attitudes toward the creation of a conservation area?
13. What legislation applies to this project?
14. How will this project be funded in the future?
15. How should use of the Kharaa River pasture be regulated?

## Appendix E: Sample Interview Questions

Interview conducted 4/29/2015

What is your role in the Tunkhel community?

Why are you interested in participating in the Conservation Project?

What are your needs?

What do you hope to see happen with the Conservation Project?

What are your strategies for increasing herder livelihood?

Is there anything else that you would like to share?